WHAT IS CLAIMED IS:

1. A method for determining tissue type, said method comprising:

quantitatively determining a tissue blood flow (TBF) by deconvoluting Q(t) and $C_a(t)$, where Q(t) represents a curve of specific mass of contrast, and $C_a(t)$ represents an arterial curve of contrast concentration;

quantitatively determining a tissue blood volume (TBV) by deconvoluting Q(t) and $C_a(t)$;

quantitatively determining a tissue mean transit time (TMTT) by deconvoluting Q(t) and $C_a(t)$;

quantitatively determining a tissue capillary permeability surface area product (TPS) by deconvoluting Q(t) and $C_a(t)$; and

determining a tissue type based on the TBF, the TBV, the TMTT, and the TPS.

2. A method in accordance with Claim 1 wherein quantitatively determining a TBV comprises quantitatively determining a TBV for a tissue having a blood stream containing a contrast without leaking the contrast into an interstitial space of the tissue by solving a matrix equation of $Q = Ah$ for a vector h, wherein vector h includes a plurality of elements comprising an impulse residue function at different times, Q comprises a vector including elements comprising values of a tissue residue function at different times, A comprises a matrix formed by values of the arterial curve of contrast concentration at different times, quantitatively determining a TBF comprises quantitatively determining a TBF for the tissue by solving the matrix equation of $Q = Ah$ for the vector h, quantitatively determining a TMTT comprises quantitatively determining a TMTT for the tissue by solving the matrix equation of $Q = Ah$ for the vector h.

3. A method in accordance with Claim 2 further comprising determining a least squares solution for the vector h under an equality constraint.

4. A method in accordance with Claim 3 wherein determining a least squares solution comprises determining a least squares solution for the vector h under a time causality constraint and a minimum transit time constraint.

5. A method in accordance with Claim 4 wherein determining a least squares solution further comprises determining a least squares solution for the vector h under a smoothness constraint, a nonnegativity constraint, and a monotonicity constraint, wherein the smoothness constraint forces h to be smoothly varying, and the monotonicity and nonnegativity constraints force h to start at a maximum and then monotonically decreases towards a zero baseline.

6. A method in accordance with Claim 1 wherein quantitatively determining a TBV comprises quantitatively determining a TBV for a tissue having a blood stream containing a contrast with leaking the contrast into an interstitial space of the tissue by solving a matrix equation of $Q = Ax$ from the linearization of the tissue residue function for a vector x, wherein vector x includes a plurality of elements comprising TBF, TBV, TMTT, TPS and combinations thereof, Q comprises a vector including elements comprising values of a tissue residue function at different times, A comprises a matrix formed by values of the arterial curve of contrast concentration and tissue residue function at different times and combinations thereof, quantitatively determining a TBF comprises quantitatively determining a TBF for the tissue by solving the matrix equation of $Q = Ax$ for the vector x, quantitatively determining a TMTT comprises quantitatively determining a TMTT for the tissue by solving the matrix equation of $Q = Ax$ for the vector x, quantitatively determining a TPS comprises quantitatively determining a TPS for the tissue by solving the matrix equation of $Q = Ax$ for the vector x.

7. A method in accordance with Claim 6 further comprising determining a least squares solution for the TBF, the TBV, the TMTT, and the TPS under a nonnegativity constraint that determines a TBV, a TBF, a TMTT and a TPS

for the tissue where there is leakage of the contrast from the blood stream into the interstitial space.

8. A method in accordance with Claim 1 further comprising quantitatively determining a partial volume averaging scaling factor for the arterial curve of contrast concentration by:

deconvoluting the measured arterial curve of contrast concentration with a venous curve of contrast concentration to determine a transit time spectrum through a tissue of interest;

extrapolating the arterial curve; and

convolving the extrapolated arterial curve with the transit time spectrum to generate an extrapolated venous curve, wherein the partial volume averaging scaling factor is the ratio of an area underneath the extrapolated arterial curve to an area underneath the extrapolated venous curve.

9. A method in accordance with Claim 1 further comprising scanning with at least one of a computed tomography (CT) system and Nuclear Magnetic Resonance system (NMR) to measure the arterial curve of contrast concentration and a tissue residue function, said quantitatively determining a TBV comprises quantitatively determining a TBV for a tissue having a blood stream containing a contrast without leaking the contrast into an interstitial space of the tissue by solving a matrix equation of $Q = Ah$ for a vector h, wherein vector h includes a plurality of elements comprising an impulse residue function at different times, Q comprises a vector including elements comprising values of the tissue residue function at different times, A comprises a matrix formed by values of the arterial curve of contrast concentration at different times, said quantitatively determining a TBF comprises quantitatively determining a TBF for the tissue by solving the matrix equation of $Q = Ah$ for the vector h, said quantitatively determining a TMTT comprises quantitatively determining a TMTT for the tissue by solving the matrix equation of $Q = Ah$ for the vector h.

10. A method in accordance with Claim 1 further comprising scanning with at least one of a computed tomography (CT) system and Nuclear Magnetic Resonance system (NMR) to measure the arterial curve of contrast concentration and a tissue residue function, said quantitatively determining a TBV comprises quantitatively determining a TBV for a tissue having a blood stream containing a contrast with leaking the contrast into an interstitial space of the tissue by solving a matrix equation of $Q = Ax$ from the linearization of the tissue residue function for a vector x, wherein vector x includes a plurality of elements comprising TBF, TBV, TMTT, TPS and combinations thereof, Q comprises a vector including elements comprising values of a tissue residue function at different times, A comprises a matrix formed by values of the arterial curve of contrast concentration and tissue residue funnction at different times and combinations thereof, said quantitatively determining a TBF comprises quantitatively determining a TBF for the tissue by solving the matrix equation of $Q = Ax$ for the vector x, said quantitatively determining a TMTT comprises quantitatively determining a TMTT for the tissue by solving the matrix equation of $Q = Ax$ for the vector x, said quantitatively determining a TPS comprises quantitatively determining a TPS for the tissue by solving the matrix equation of $Q = Ax$ for the vector x.

11. A method in accordance with Claim 1 wherein the TBF is a cerebral blood flow (CBF), the TBV is a cerebral blood volume (CBV), the TMTT is a cerebral mean transit time (CMTT), the TPS is a cerebral TPS, said determining a tissue type based on the TBF, the TBV, the TMTT, and the TPS comprises determining one of a viable tissue and a non-viable tissue based on the CBF, the CBV, the CMTT, and the cerebral TBS.

12. A system comprising at least one of a computed tomography system and a nuclear magnetic resonance system, said system configured to:

quantitatively determine a tissue blood flow (TBF) by deconvoluting Q(t) and $C_a(t)$, where Q(t) represents a curve of specific mass of contrast, and $C_a(t)$ represents an arterial curve of contrast concentration;

quantitatively determine a tissue blood volume (TBV) by deconvoluting Q(t) and $C_a(t)$;

quantitatively determine a tissue mean transit time (TMTT) by deconvoluting Q(t) and $C_a(t)$;

quantitatively determine a tissue capillary permeability surface area product (TPS) by deconvoluting Q(t) and $C_a(t)$; and

determine a tissue type based on the TBF, the TBV, the TMTT, and the TPS.

13. A system according to Claim 12 further configured to:

quantitatively determine a TBV for a tissue having a blood stream containing a contrast without leaking the contrast into an interstitial space of the tissue by solving a matrix equation of $Q = Ah$ for a vector h, wherein vector h includes a plurality of elements comprising an impulse residue function at different times, Q comprises a vector including elements comprising values of a tissue residue function at different times, A comprises a matrix formed by values of the arterial curve of contrast concentration at different times;

quantitatively determine a TBF for the tissue by solving the matrix equation of $Q = Ah$ for the vector h; and

quantitatively determine a TMTT for the tissue by solving the matrix equation of $Q = Ah$ for the vector h.

14. A system according to Claim 13 further configured to determine a least squares solution for the vector h under an equality constraint.

15. A system according to Claim 14 further configured to determine a least squares solution for the vector h under a time causality constraint and a minimum transit time constraint.

16. A system according to Claim 15 further configured to determine a least squares solution for the vector h under a smoothness constraint, a nonnegativity constraint, and a monotonicity constraint, wherein the smoothness constraint forces h to be smoothly varying, and the monotonicity and nonnegativity constraints force h to start at a maximum and then monotonically decreases towards a zero baseline.

17. A system according to Claim 12 further configured to:

quantitatively determine a TBV for a tissue having a blood stream containing a contrast with leaking the contrast into an interstitial space of the tissue by solving a matrix equation of $Q = Ax$ from the linearization of the tissue residue function for a vector x, wherein vector x includes a plurality of elements comprising TBF, TBV, TMTT, TPS and combinations thereof, Q comprises a vector including elements comprising values of a tissue residue function at different times, A comprises a matrix formed by values of the arterial curve of contrast concentration and tissue residue function at different times and combinations thereof;

quantitatively determine a TBF for the tissue by solving the matrix equation of $Q = Ax$ for the vector x;

quantitatively determine a TMTT for the tissue by solving the matrix equation of $Q = Ax$ for the vector x; and

quantitatively determine a TPS for the tissue by solving the matrix equation of $Q = Ax$ for the vector x.

18. A system according to Claim 17 further configured to determine a least squares solution for the TBF, the TBV, the TMTT, and the TPS under a nonnegativity constraint that determines a TBV, a TBF, a TMTT and a TPS for the tissue where there is leakage of the contrast from the blood stream into the interstitial space.

19. A system according to Claim 12 further configured to quantitatively determine a partial volume averaging scaling factor for the arterial curve of contrast concentration by:

deconvoluting the measured arterial curve of contrast concentration with a venous curve of contrast concentration to determine a transit time spectrum through a tissue of interest;

extrapolating the arterial curve; and

convolving the extrapolated arterial curve with the transit time spectrum to generate an extrapolated venous curve, wherein the partial volume averaging scaling factor is the ratio of an area underneath the extrapolated arterial curve to an area underneath the extrapolated venous curve.

20. A system according to Claim 12, wherein the TBF is a cerebral blood flow (CBF), the TBV is a cerebral blood volume (CBV), the TMTT is a cerebral mean transit time (CMTT), the TPS is a cerebral TPS, said system further configured to determine one of a viable tissue and a non-viable tissue based on the CBF, the CBV, the CMTT, and the cerebral TBS.

21. A computer readable medium encoded with a program executable by a computer for processing scanning data, said program configured to instruct the computer to:

quantitatively determine a tissue blood flow (TBF) by deconvoluting Q(t) and $C_a(t)$, where Q(t) represents a curve of specific mass of contrast, and $C_a(t)$ represents an arterial curve of contrast concentration;

quantitatively determine a tissue blood volume (TBV) by deconvoluting Q(t) and $C_a(t)$;

quantitatively determine a tissue mean transit time (TMTT) by deconvoluting Q(t) and $C_a(t)$;

quantitatively determine a tissue capillary permeability surface area product (TPS) by deconvoluting Q(t) and $C_a(t)$; and

determine a tissue type based on the TBF, the TBV, the TMTT, and the TPS.

22. A computer readable medium in accordance with Claim 21 wherein said program is further configured to:

quantitatively determine a TBV for a tissue having a blood stream containing a contrast without leaking the contrast into an interstitial space of the tissue by solving a matrix equation of $Q = Ah$ for a vector h, wherein vector h includes a plurality of elements comprising an impulse residue function at different times, Q comprises a vector including elements comprising values of a tissue residue function at different times, A comprises a matrix formed by values of the arterial curve of contrast concentration at different times;

quantitatively determine a TBF for the tissue by solving the matrix equation of $Q = Ah$ for the vector h; and

quantitatively determine a TMTT for the tissue by solving the matrix equation of $Q = Ah$ for the vector h.

23. A computer readable medium in accordance with Claim 22 wherein said program is further configured to determine a least squares solution for the vector h under an equality constraint.

24. A computer readable medium in accordance with Claim 23 wherein said program is further configured to determine a least squares solution for the vector h under a time causality constraint and a minimum transit time constraint.

25. A computer readable medium in accordance with Claim 24 wherein said program is further configured to determine a least squares solution for the vector h under a smoothness constraint, a nonnegativity constraint, and a

monotonicity constraint, wherein the smoothness constraint forces h to be smoothly varying, and the monotonicity and nonnegativity constraints force h to start at a maximum and then monotonically decreases towards a zero baseline.

26. A computer readable medium in accordance with Claim 21 wherein said program is further configured to:

quantitatively determine a TBV for a tissue having a blood stream containing a contrast with leaking the contrast into an interstitial space of the tissue by solving a matrix equation of $Q = Ax$ from the linearization of the tissue residue function for a vector x, wherein vector x includes a plurality of elements comprising TBF, TBV, TMTT, TPS and combinations thereof, Q comprises a vector including elements comprising values of a tissue residue function at different times, A comprises a matrix formed by values of the arterial curve of contrast concentration and tissue residue function at different times and combinations thereof;

quantitatively determine a TBF for the tissue by solving the matrix equation of $Q = Ax$ for the vector x;

quantitatively determine a TMTT for the tissue by solving the matrix equation of $Q = Ax$ for the vector x; and

quantitatively determine a TPS for the tissue by solving the matrix equation of $Q = Ax$ for the vector x.

27. A computer readable medium in accordance with Claim 26 wherein said program is further configured to determine a least squares solution for the TBF, the TBV, the TMTT, and the TPS under a nonnegativity constraint that determines a TBV, a TBF, a TMTT and a TPS for the tissue where there is leakage of the contrast from the blood stream into the interstitial space.

28. A computer readable medium in accordance with Claim 21 wherein to quantitatively determine a partial volume averaging scaling factor for the arterial curve of contrast concentration said program is further configured to:

deconvolute the measured arterial curve of contrast concentration with a venous curve of contrast concentration to determine a transit time spectrum through a tissue of interest;

extrapolate the arterial curve; and

convolve the extrapolated arterial curve with the transit time spectrum to generate an extrapolated venous curve, wherein the partial volume averaging scaling factor is the ratio of an area underneath the extrapolated arterial curve to an area underneath the extrapolated venous curve.

29. A computer readable medium in accordance with Claim 21 wherein the TBF is a cerebral blood flow (CBF), the TBV is a cerebral blood volume (CBV), the TMTT is a cerebral mean transit time (CMTT), the TPS is a cerebral TPS, said program is further configured to determine one of a viable tissue and a non-viable tissue based on the CBF, the CBV, the CMTT, and the cerebral TBS.

30. A computer readable medium in accordance with Claim 21 wherein said program is further configured to:

scan with at least one of a computed tomography (CT) system and Nuclear Magnetic Resonance system (NMR) to measure the arterial curve of contrast concentration and a tissue residue function;

quantitatively determine a TBV for a tissue having a blood stream containing a contrast without leaking the contrast into an interstitial space of the tissue by solving a matrix equation of $Q = Ah$ for a vector h, wherein vector h includes a

plurality of elements comprising an impulse residue function at different times, Q comprises a vector including elements comprising values of a tissue residue function at different times, A comprises a matrix formed by values of the arterial curve of contrast concentration at different times;

quantitatively determine a TBF for the tissue by solving the matrix equation of $Q = Ah$ for the vector h;

quantitatively determine a TMTT for the tissue by solving the matrix equation of $Q = Ah$ for the vector h; and

quantitatively determine a TPS for the tissue by solving the matrix equation of $Q = Ah$ for the vector h.

31. A computer readable medium in accordance with Claim 21 wherein said program is further configured to:

scan with at least one of a computed tomography (CT) system and Nuclear Magnetic Resonance system (NMR) to measure the arterial curve of contrast concentration and a tissue residue function;

quantitatively determine a TBV for a tissue having a blood stream containing a contrast with leaking the contrast into an interstitial space of the tissue by solving a matrix equation of $Q = Ax$ from the linearization of the tissue residue function for a vector x, wherein vector x includes a plurality of elements comprising TBF, TBV, TMTT, TPS and combinations thereof, Q comprises a vector including elements comprising values of a tissue residue function at different times, A comprises a matrix formed by values of the arterial curve of contrast concentration and tissue residue function at different times and combinations thereof;

quantitatively determine a TBF for the tissue by solving the matrix equation of $Q = Ax$ for the vector x;

quantitatively determine a TMTT for the tissue by solving the matrix equation of $Q = Ax$ for the vector x; and

quantitatively determine a TPS for the tissue by solving the matrix equation of $Q = Ax$ for the vector x.